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# **Germ Plasm Evaluation Program**

Progress Report No. 7

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**Roman L. Hruska**  
**U.S. Meat Animal Research Center**

In cooperation with  
Kansas State University  
and the University of Nebraska

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The cattle Germ Plasma Evaluation Program at the Roman L. Hruska U.S. Meat Animal Research Center is designed to characterize different biological types represented by breeds varying widely in characteristics such as milk production, growth, mature size and carcass composition. A major objective is to characterize breeds representing different biological types in different feed environments and production situations for the full spectrum of biological traits relating to economic beef production.

A coordinated research effort is employed involving scientists from the disciplines of animal breeding, reproductive physiology, nutrition, meats, and management systems. The program was initiated in 1969. Progress reports have been published annually summarizing current results from each cycle and phase of the program for traits of principal economic importance to the beef cattle industry.

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# CATTLE GERM PLASM EVALUATION PROGRAM<sup>1</sup>

## PROGRESS REPORT NO. 7

ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER

The cattle Germ Plasm Evaluation Program has been conducted in three cycles. Cycle I involved breeding Hereford, Angus, Jersey, South Devon, Limousin, Simmental and Charolais bulls by artificial insemination (AI) to Hereford and Angus cows to produce three calf crops (Cycle I, Phase 2) in the spring of 1970, 1971 and 1972.

Cycle II, initiated with the 1972 breeding season, involved the Hereford and Angus cows used in the first cycle. These cows were bred by AI to Hereford, Angus, Red Poll, Brown Swiss, Gelbvieh, Maine Anjou and Chianina sires to produce two calf crops (Cycle II, Phase 2) in the spring of 1973 and 1974. In addition, in Cycle II, Phase 2, Red Poll and Brown Swiss cows were added to the program and mated to Hereford, Angus, Red Poll and Brown Swiss sires to provide for a four-breed diallel crossbreeding experiment.

Cycle III was initiated during the 1974 breeding season. In Cycle III, the Hereford and Angus cows used to initiate Cycles I and II were mated by AI to Hereford, Angus, Pinzgauer, Tarentaise, Brahman, and Sahiwal sires to produce two calf crops (Cycle III, Phase 2) in the spring of 1975 and 1976.

Fifteen of the Hereford and 16 of the Angus sires used in Cycle I were also used in Cycle II and Cycle III to insure a stable control population of Hereford and Angus reciprocal crosses that are used as a basis for comparison between different cycles and phases of the program. Within each cycle of sire breeds, foundation cows (Hereford and Angus, in Cycles I, II and III, plus Red Poll and Brown Swiss in Cycle II) are referred to as Phase 1. Their calves are called Phase 2, and the calves from Phase 2 cows are designated Phase 3. Specific mating plans for each cycle and phase of the program are provided in the appendix.

Previous progress reports have presented completed data for Cycles I, II and III and are available by request. Progress Report No. 1 (ARS-NC-13, 1974) included birth and weaning traits of Cycle I, Phase 2, calves and postweaning growth, feed efficiency and carcass and meat traits of the steers. Progress Report No. 2 (ARS-NC-22, 1975) included the growth, reproduction and maternal performance of Cycle I, Phase 2, females through 2 years of age and, for Cycle II, Phase 2, the preweaning traits for both calf crops and the steer postweaning traits for the 1973 calf crop. Progress Report No. 3 (ARS-NC-41, 1976) presented a complete summary and discussion of Cycle I, Phase 2, results

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from birth through slaughter for steers and from birth through puberty for the heifers. Progress Report No. 4 (ARS-NC-48, 1976) included reproduction and maternal performance of Cycle I, Phase 2, cows as 3-year-olds, preweaning and postweaning information for Cycle I, Phase 3, calves, and postweaning steer data for the 1974 calf crop and postweaning heifer data for both calf crops of Cycle II, Phase 2, calves. For results on calving, reproduction and maternal performance of Cycle I, Phase 3, and Cycle II, Phase 2, cows as 2-year-olds, readers are referred to Progress Report No. 5 (ARS-NC-55, 1977). Progress Report No. 5 also included complete results for birth and weaning traits on Cycle III, Phase 2, calves. Progress Report No. 6 (ARM-NC-2, 1978) included postweaning growth, and carcass data of steers and growth, puberty and conception data of heifers in Cycle II, Phase 3 and Cycle III, Phase 2.

This report provides reproduction and maternal performance data for Cycle I, Phase 2, cows as 4-, 5-, 6-, 7- and 8-year-olds; Cycle II, Phase 2, cows as 3-, 4- and 5-year olds; Cycle II, Phase 3, cows as 2-year-olds and Cycle III, Phase 2 cows as 2-year-olds and 3-year-olds.

General releases of information on individual sires are not planned because erroneous conclusions may be drawn from the ranking of individual sires with the relatively small number of progeny per sire in this program. The objective of the program is to characterize breeds as representatives of different biological types. To do this effectively, a large sample of sires of each breed is necessary. Thus, the number of progeny per sire is generally low. A relatively large number of progeny per sire are required for a high level of accuracy in ranking individual sires on their breeding value for most economic traits.

## CYCLE I, PHASE 2

Foundation Cows. The foundation Hereford and Angus cows used in the program were purchased as calves at weaning from commercial producers in Nebraska. The cows were 2 through 5 years of age, 2 through 6 years of age, and 3 through 7 years of age at calving in 1970, 1971 and 1972, respectively.

Sires. In Cycle I, 32 Hereford, 35 Angus, 33 Jersey, 28 South Devon, 20 Limousin, 28 Simmental and 26 Charolais bulls were used during the 1969, 1970 and 1971 breeding seasons. The Hereford and Angus bulls used in this program were sampled from bulls that had been selected on individual performance information, which was the basis for entering into the progeny testing programs of commercial artificial insemination organizations. The Jersey bulls were selected at random from two commercial AI organizations, and the South Devon bulls were sampled from an importation made in 1969 by a commercial organization. Simmental, Limousin and Charolais bulls were sampled from bulls available from commercial AI organizations and from the Canada Department of Agriculture for the Simmental and Limousin.

For a cooperative study with the Canada Department of Agriculture, Hereford x Angus, Jersey x Angus, Simmental x Angus and Charolais x Angus heifers were randomly selected at weaning time and shipped, 4 to 8 weeks after weaning, to the Research Station, Lethbridge, Alberta. There were 12 heifers

per breed group in 1970 and 10 heifers per breed group in 1971 and 1972. These females and their offspring were individually fed to evaluate efficiency of production.

Matings. Cycle I, Phase 2, yearling heifers were mated to Hereford, Angus, Brahman, Devon and Holstein bulls during a 45- to 46-day AI season and to Hereford and Angus bulls for a 21- to 24-day cleanup period in 1971, 1972 and 1973 (appendix table 3). As 2-year-old cows, they were mated to Hereford, Angus, Chianina, Gelbvieh and Maine Anjou bulls for a 42- to 45-day AI season and to Hereford and Angus bulls during a 22-day cleanup in 1972, 1973 and 1974. As 3-year-olds and above, the cows are being mated by natural service to Brown Swiss (predominantly European) bulls for 63 days.

Data Analysis. Calving difficulty, calf mortality, calf birth weight and preweaning growth were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of cow's sire, breed of cow's dam, cow age-year, sex and two-way interactions. Birth and 200-day weight and preweaning growth rate were adjusted to a steer basis by adjustment factors calculated from the data and shown in the table foot-notes. Calf crop percentage, pregnancy rate, cow weights and heights were analyzed with a similar least-squares procedure except that sex and two-way interactions with sex were not included in the model.

Calving Difficulty. Calving difficulty scores were assigned to each calf at birth on the basis of the following system:

Score

- |                         |   |
|-------------------------|---|
| 1 No difficulty         | - Calves unassisted.  |
| 2 Little difficulty     | - Assistance given by hand, but no jack or puller used; assistance actually may not have been required.       |
| 3 Moderate difficulty   | - Assistance given with jack or calf-puller; some difficulty was encountered even with the puller being used. |
| 4 Major difficulty      | - Calf jack used and major difficulty encountered usually 30 minutes or more required to deliver calf.        |
| 5 Caesarean birth       | - Performed after determination made that calf could not be delivered with a calf-puller.                     |
| 6 Abnormal presentation | - Assistance given: posterior, head back, leg back, and so forth.   |

Summaries of calving difficulty in 4-, 5-, 6-, 7- and 8-year-old cows are provided in table 1. For these summaries, scores of 1 and 2 were combined and are designated no difficulty and scores of 3 and 4 were combined and are designated calf-puller.



Reproductive and Maternal Performance. Information is presented on rebreeding performance of 4-, 5-, 6-, 7- and 8-year-olds in table 2. Least squares means for cow weight at fall palpation time and fall hip height measurements when cows were 6½-, 7½- and 8½-years of age are also included in table 2. Preweaning growth and calf crop percentages are provided in table 1 for calves from these same cows.

## CYCLE II, PHASE 2

Cows. The foundation Hereford and Angus cows used in Cycle I were continued in Cycle II of the program. The cows calving in 1973 were 4 to 8 years of age and in 1974 were 4 to 9 years of age. As previously indicated, mature Brown Swiss and Red Poll cows were added to these herds for the 1972 and 1973 breeding season.

Sires. In Cycle II, 15 Hereford, 16 Angus, 16 Red Poll, 11 Brown Swiss, 11 Gelbvieh, 18 Maine Anjou and 20 Chianina bulls were used during the 1972 and 1973 breeding seasons. The Hereford and Angus sires had also been used in Cycle I of the program, and the other bulls were sampled from commercial organizations. The Brown Swiss sires included four domestic bulls and seven bulls imported into Canada from Switzerland and Germany.

Birth, Preweaning and Postweaning Data. Data on calving difficulty and preweaning growth for both calf crops produced (1973-74) and postweaning growth, feed efficiency and carcass and meat traits for the first calf crop of Cycle II, Phase 2, were summarized previously (ARS-NC-22, Progress Report No. 2, 1975). In addition, steer postweaning data from the second calf crop, and heifer postweaning growth, puberty and conception for both calf crops were reported previously (ARS-NC-48, Progress Report No. 4, 1976). Data on calving difficulty, reproduction, maternal performance and size of 2-year-olds were presented in Progress Report No. 5 (ARS-NC-55, 1977).

Calving and Rebreeding of 3- and 4-Year-Olds. Data on calving difficulty, calf crop percentage and birth and weaning weights of calves from 3-, 4- and 5-year-old dams (born in 1973-74) are presented in table 3 for cows out of Hereford and Angus dams. Data on rebreeding performance and size as 3-, 4-, and 5-year-olds are given in table 4. The cows were bred as 2-, 3- and 4-year-olds by natural service to ¾ Simmental bulls.

Calving difficulty, calf mortality, calf birth weight and preweaning growth were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of dam's sire, breed of dam's dam, year-age of cow, sex of calf and two-way interactions. Birth and 200-day weight and preweaning growth rate were adjusted to a steer basis by adjustment factors calculated from the data and shown in table footnotes. Calf crop percentage, pregnancy rate, cow weights and cow heights were analyzed by similar least-squares procedures except that sex and interactions with sex were not included in the model.



## CYCLE II, PHASE 3

Sires. The mating plans to produce Cycle II, Phase 3, calves are presented in appendix table 4. There were 13 Hereford, 14 Angus, 13 Santa Gertrudis and 14 Brangus sires used by AI to produce the two calf crops (1975-76). These sires were sampled from commercial organizations, with the Hereford and Angus sires being the same as used in other cycles and phases of the program. Calves resulting from cleanup matings to Hereford and Angus sires were also included in this summary. Calving difficulty, calf survival and preweaning growth were presented in Progress Report No. 5 (ARS-NC-55, 1977). Postweaning growth and carcass data on steers and postweaning growth, puberty and conception data on heifers were summarized in Progress Report No. 6 (ARM-NC-2, 1978).

Calving and Rebreding of 2-Year-Olds. Data on calving difficulty, calf crop percentage and birth and weaning weights of calves from 2-year-old dams (born in 1975-76) are presented in table 5 according to breed of cows sire. Data for corresponding breed groups on rebreeding performance and size as 2-year-olds are given in table 6.

Calving difficulty, calf mortality, calf birth weight and preweaning growth were analyzed by least-squares procedures for unequal subclass numbers using a model that included the effects of breed of dam's sire, breed of dam's dam, breed of sire, year, sex and two-way interactions. Birth and 200-day weight and preweaning growth rate were adjusted to a steer basis by adjustment factors calculated from the data and shown in table footnotes. Calf crop percentage, pregnancy rate, cow weight and cow height were analyzed by similar least-squares procedures except that sex and interactions with sex were deleted from the model.

## CYCLE III, PHASE 2

Cows. The foundation Hereford and Angus cows used to produce Phase 2 calves in Cycles I and II were continued in Cycle III of the program (appendix table 5). The two calf crops in Cycle III, Phase 2, were produced in 1975 and 1976.

Sires. There were 13 Hereford, 14 Angus, 17 Brahman, 6 Sahiwal, 9 Pinzgauer and 7 Tarentaise sires used during the 1974 and 1975 breeding seasons. The Hereford and Angus bulls had also been used in Cycle I and Cycle II of the program, and the Brahman bulls were sampled from commercial AI organizations or purebred Brahman herds. Semen was available from only two Sahiwal bulls (imported from Australia) and one Tarentaise bull for the 1974 breeding season. Semen was available on four additional Sahiwal bulls and six additional Tarentaise bulls for the 1975 breeding season to produce the Cycle III, Phase 2, calf crop in 1976.

A sample of about 32 heifers from each of the Angus-Hereford, Hereford-Angus, Brahman-Hereford, Brahman-Angus, Sahiwal-Hereford, Sahiwal-Angus, Pinzgauer-Hereford and Pinzgauer-Angus breed groups were transferred to the U.S. Department of Agriculture station at Brooksville, Fla., for an interregional study cooperative with the Florida Agricultural Experiment Station to evaluate

genotype-environment interactions involving maternal traits. These heifers and those remaining at the Roman L. Hruska U.S. Meat Animal Research Center are being mated by natural service to bulls sampled from the same population of Red Poll (for first calf crop) and 7/8 Simmental (second through fourth calf crops) to evaluate reproduction and maternal performance in each environment. Calving traits and preweaning growth data for all calves born in 1975 and 1976 were presented in Progress Report No. 5 (ARS-NC-55, 1977). Postweaning growth, feed efficiency and carcass traits of steers and postweaning growth, puberty and conception of yearling heifers were presented in Progress Report No. 6 (ARM-NC-2, 1978).

Reproduction and Maternal Performance. Data on calving difficulty, percentage calf crop and birth and weaning weight of progeny from 2-year-old Cycle III, Phase 2, females (born in 1975 and 1976) are presented in table 7. Data on rebreeding performance and size as 2-year-olds are given for the corresponding breed group in table 8. The Cycle III, Phase 2, females were bred as yearlings by natural service to Red Poll sires. These data were analyzed by least-squares procedures using a model that included effects of breed of sire, breed of dam, year and their two-way interactions. Sex of calf and two way interactions with sex were deleted from models for calf crop percentage, rebreeding performance and cow size.

Data on calving difficulty, percentage calf crop and birth and weaning weight of progeny from 3-year-old Cycle III, Phase 2, females (born in 1975) are presented in table 9. Data on rebreeding performance and size as 3-year-olds are given for the corresponding breed group in table 10. The Cycle III, Phase 2, females were bred as 2- and 3-year-olds to 7/8 Simmental sires. The calving and rebreeding data as 3-year-olds on the 1976 heifers born in Cycle III, Phase 2, are not yet available. Thus, the data presented in tables 11 and 12 are preliminary, representing that from only the first of two calf crops that will be obtained on females calving as 3-year-olds. These data were analyzed by least-squares procedures using a model that included effects of sire-dam breed groups. Effects of sex of calf and sex-breed group interaction were also included in models for calving difficulty and birth and weaning weight of progeny.

TABLE 1. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT, WEANING WEIGHT  
AND WEANING WEIGHT RATIO OF CALVES FROM 4-, 5-, 6-, 7- AND 8-YEAR OLD COWS<sup>a</sup>  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

Sire	Breed of Cow Dam	No. Calves Born	Type of Parturition, %			Calf Crop, % <sup>c</sup>			Calf Mortality, % <sup>d</sup>			Calf Wt, lbs	
			No. Diff.	Calv- Puller	C- Section	Abn. Pre- sentation	Born	Weaned	Early	Late	Birth	200- Day	200-Day Wt Ratio <sup>f</sup>
Angus Hereford	Hereford	224	97.0	0.5	0.0	2.5	95.8	87.7	2.5	5.3	91.3	507	101.2
	Angus	237	95.5	3.1	0.4	1.0	95.6	89.8	4.0	1.1	91.6	495	98.8
	Average	461	96.3	1.8	0.2	1.7	95.7	88.7	3.3	3.2	91.4	501	100.0
Jersey	Hereford	217	98.9	1.0	0.0	0.1	96.8	92.9	3.0	1.3	85.6	516	103.0
	Angus	161	98.0	0.6	0.0	1.4	89.5	82.4	4.1	3.8	81.1	509	101.6
	Average	378	98.5	0.8	0.0	0.7	93.1	87.6	3.5	2.5	83.4	512	102.2
South Devon	Hereford	184	93.5	2.3	0.6	3.6	93.3	90.5	1.2	1.7	98.1	520	103.8
	Angus	166	93.8	3.0	0.0	3.2	92.9	90.9	1.6	1.1	92.7	517	103.2
	Average	350	93.7	2.7	0.3	3.4	93.1	90.7	1.4	1.4	95.4	519	103.6
Limousin	Hereford	259	96.1	2.2	0.1	1.6	93.6	84.7	6.1	2.0	94.5	515	102.8
	Angus	269	93.7	2.6	0.4	3.2	97.9	89.3	6.8	0.7	89.9	505	100.8
	Average	528	94.9	2.4	0.3	2.4	95.8	87.0	6.4	1.4	92.2	510	101.8
Simmental	Hereford	296	91.1	6.1	0.3	2.4	94.7	88.2	5.9	1.1	97.8	551	110.0
	Angus	238	93.1	3.7	0.0	3.2	92.5	84.8	6.4	2.0	94.5	547	109.2
	Average	534	92.1	4.9	0.2	2.8	93.6	86.5	6.1	1.6	96.1	549	109.6
Charolais	Hereford	263	90.2	4.4	1.6	3.8	94.8	85.5	6.6	3.3	97.9	532	106.2
	Angus	164	92.6	3.0	0.1	4.3	93.4	85.0	6.5	1.6	97.6	531	106.0
	Average	427	91.4	3.7	0.8	4.1	94.1	85.3	6.6	2.4	97.7	531	106.0
Average All Sire Breeds	Hereford	1443	94.5	2.8	0.4	2.3	94.8	88.3	4.2	2.5	94.2	524	104.6
	Angus	1235	94.5	2.7	0.2	2.7	93.6	87.0	4.9	1.7	91.2	517	103.2
	Average	2678	94.5	2.7	0.3	2.5	94.2	87.6	4.6	2.1	92.7	520	103.8

<sup>a</sup> Calves from these cows were sired by Brown Swiss bulls (appendix table 3).

<sup>b</sup> No assistance or minor hand assistance.

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open two successive years or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 6.5 lb for birth weight and 34 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 501 lb average for Hereford and Angus sired dams.

TABLE 2. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 6-, 7- AND 8-YEAR OLD COWS  
CYCLE I, PHASE 2 - COWS BORN 1970-71-72

Sire	Breed of Cow	Dam	No. Cows			Avg. Calving Date <sup>a</sup>	Percent Preg. <sup>b</sup>	Cow Weight, lb			Hip Height, in		
			6-Yr. Olds	7-Yr. Olds	8-Yr. Olds			6½/2 Years	7½/2 Years	8½/2 Years	6½/2 Years	7½/2 Years	8½/2 Years
Angus Hereford	Hereford Angus Average		56 59 115	38 43 81	17 22 39	April 1 April 5 April 3	94.4 96.1 95.2	1172 1167 1169	1202 1233 1217	1161 1203 1182	47.8 48.3 48.0	48.4 48.6 48.5	48.4 48.5 48.4
Jersey	Hereford Angus Average		51 45 96	46 26 72	23 12 35	March 29 March 29 March 29	97.9 92.6 95.2	1009 1026 1018	1060 1041 1051	1047 1015 1031	48.6 48.0 48.3	48.6 47.8 48.2	48.5 47.3 47.9
South Devon	Hereford Angus Average		50 41 91	25 32 57	10 13 23	April 6 April 1 April 4	93.4 93.8 93.6	1234 1199 1217	1247 1244 1245	1279 1234 1256	50.5 50.2 50.4	50.5 50.2 50.3	50.3 50.4 50.3
Limousin	Hereford Angus Average		70 67 137	37 45 82	25 23 48	April 5 April 1 April 3	94.9 96.5 95.7	1203 1183 1193	1234 1218 1226	1244 1226 1235	50.7 50.1 50.4	50.6 49.9 50.2	50.1 49.5 49.8
Simental	Hereford Angus Average		78 63 141	50 46 96	20 20 40	April 6 April 2 April 4	95.4 93.5 94.4	1231 1214 1223	1271 1277 1274	1289 1228 1259	51.2 50.5 50.9	51.4 50.4 50.9	51.3 50.4 50.8
Charolais	Hereford Angus Average		65 45 110	44 24 68	27 12 39	April 5 April 5 April 5	95.4 92.8 94.1	1296 1286 1291	1357 1333 1345	1312 1348 1330	51.1 50.8 51.0	51.1 50.9 51.0	50.6 50.4 50.5
Average All Sire Breeds	Hereford Angus Average		370 320 690	240 216 456	122 102 224	April 4 April 2 April 3	95.2 94.2 94.7	1191 1179 1185	1229 1224 1226	1222 1209 1216	50.0 49.7 49.8	50.1 49.6 49.9	49.9 49.4 49.6

<sup>a</sup> Includes cows calving at 4-, 5-, 6-, 7- and 8-years of age.

<sup>b</sup> Breeding period was 63 days by natural service to Brown Swiss bulls (appendix table 3). Percent pregnant = no. palpated as pregnant ÷ no. palpated, and only includes cows that calved prior to breeding.

TABLE 3. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT, WEANING WEIGHT  
AND WEANING WEIGHT RATIO OF CALVES FROM 3-, 4- AND 5-YEAR-OLD COWS<sup>a</sup>  
CYCLE II, PHASE 2 - COWS BORN 1973-74

Breed of Cow		No. Calves Born	Type of Parturition, %			Calf Crop, % <sup>c</sup> Calf Mortality, % <sup>d</sup>				Calf Wt, lb. <sup>e</sup>			
Sire	Dam		No Diff.	Calf- b Puller	C- Section	Abn. Pre-sentation	Born	Weaned	Early	Late	Birth	200- Day	200-Day f Wt Ratio
Angus Hereford	Hereford	80	92.1	4.0	0.0	3.9	88.7	84.1	3.8	2.2	86.9	475	100.6
	Angus	113	81.8	16.5	0.0	1.8	96.2	92.1	1.3	2.1	88.0	470	99.6
	Average	193	86.9	10.2	0.0	2.8	92.5	88.1	2.6	2.1	87.4	472	100.0
Red Poll	Hereford	81	83.3	14.3	0.0	2.5	92.0	85.9	4.3	2.2	92.1	501	106.1
	Angus	105	91.6	3.1	0.1	5.2	88.9	79.1	8.7	1.3	86.3	487	103.2
	Average	186	87.5	8.7	0.0	3.9	90.5	82.5	6.5	1.7	89.2	494	104.7
Brown Swiss	Hereford	141	82.2	12.2	0.7	4.8	92.0	88.1	4.0	0.8	95.4	533	112.9
	Angus	142	95.2	3.7	0.0	1.2	97.3	93.1	3.4	1.4	90.2	529	112.1
	Average	283	88.7	8.0	0.4	3.0	94.6	90.6	3.7	1.1	92.8	531	112.5
Gelbvieh	Hereford	93	86.7	10.5	0.2	2.7	96.6	89.0	3.5	2.1	94.0	533	112.9
	Angus	101	94.0	3.8	0.9	1.3	97.0	89.2	7.0	1.0	87.6	523	110.8
	Average	194	90.3	7.1	0.5	2.0	96.8	89.1	5.2	1.5	90.8	528	111.9
Maine Anjou	Hereford	91	90.2	7.6	0.0	2.1	94.1	86.9	4.2	3.4	99.4	524	111.0
	Angus	108	88.2	9.0	0.1	2.7	94.2	89.5	2.7	1.8	96.6	509	107.8
	Average	199	89.2	8.3	0.0	2.4	94.1	88.2	3.4	2.6	98.0	517	109.5
Chianina	Hereford	93	95.4	2.8	0.8	1.0	95.4	90.5	1.1	4.1	100.1	523	110.8
	Angus	100	95.0	4.6	0.7	0.0	95.6	90.8	3.7	0.6	95.2	515	109.1
	Average	193	95.2	3.7	0.8	0.3	95.5	90.6	2.4	2.4	97.6	519	110.0
Average All Sire Breeds	Hereford	579	88.3	8.6	0.3	2.8	93.2	87.4	3.5	2.5	94.7	515	109.1
	Angus	669	91.0	6.8	0.3	2.0	94.9	89.0	4.5	1.4	90.7	506	107.2
	Average	1248	89.6	7.7	0.3	2.4	94.0	88.2	4.0	1.9	92.7	510	108.1

<sup>a</sup> Calves from these cows were sired by 3/4 Simmental bulls (appendix table 4).

<sup>b</sup> No assistance or minor hand assistance.

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open two successive years or by death.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 6.6 lb for birth weight and 31 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 472 lb average for Hereford and Angus sired dams.



TABLE 4. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 3-, 4- AND 5-YEAR-OLD COWS  
CYCLE II, PHASE 2 - COWS BORN 1973-74

Sire	Breed of Cow	Dam	No. Cows			Avg. Calving Date	Percent Preg. <sup>a</sup>	Cow Weight, lb			Cow Hip Height, in		
			3-Yr. Olds	4-Yr. Olds	5-Yr. Olds			3 1/2 Years	4 1/2 Years	5 1/2 Years	3 1/2 Years	4 1/2 Years	5 1/2 Years
Angus Hereford	Hereford Angus Average		33 47 80	34 48 82	15 20 35	March 29 April 1 March 31	90.2 95.3 92.7	1050 991 1021	1147 1081 1114	1143 1115 1129	47.7 47.0 47.4	48.3 47.6 47.9	49.0 48.3 48.7
Red Poll	Hereford Angus Average		35 46 81	38 49 87	11 17 28	March 30 March 30 March 30	91.1 89.7 90.4	987 967 977	1073 1068 1071	1044 1091 1067	48.3 48.0 48.1	48.6 48.1 48.3	48.3 48.3 48.3
Brown Swiss	Hereford Angus Average		58 60 118	63 60 123	24 21 45	March 31 March 30 March 31	97.2 96.3 96.7	1034 1021 1028	1125 1098 1112	1147 1106 1127	49.9 49.3 49.6	50.3 50.0 50.1	51.0 50.2 50.6
Gelbvieh	Hereford Angus Average		37 41 78	35 40 75	19 22 41	April 3 March 31 April 1	97.6 95.1 96.4	1059 1051 1055	1165 1156 1161	1197 1154 1175	50.1 49.4 49.7	50.7 49.9 50.3	51.0 49.9 50.4
Maine Anjou	Hereford Angus Average		35 44 79	38 48 86	21 18 39	March 30 March 29 March 30	94.6 94.3 94.5	1121 1119 1120	1225 1221 1223	1297 1264 1280	50.6 49.9 50.2	51.1 50.4 50.7	51.7 50.5 51.1
Chianina	Hereford Angus Average		38 42 80	42 43 85	14 16 30	April 3 April 1 April 2	93.5 95.4 94.4	1143 1132 1138	1242 1236 1239	1295 1252 1273	54.0 53.2 53.6	54.4 53.5 53.9	55.2 54.0 54.6
Average All Sire Breeds	Hereford Angus Average		236 280 516	250 288 538	104 114 218	March 31 March 31 March 31	94.0 94.4 94.2	1066 1047 1056	1163 1143 1153	1187 1164 1175	50.1 49.5 49.8	50.6 49.9 50.2	51.0 50.2 50.6

<sup>a</sup> Breeding period was 63 days by natural service to 3/4 Simmental bulls (appendix table 4). Percent pregnant = no. palpated as pregnant ÷ no. palpated, and only include cows that calved prior to breeding.

TABLE 5. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT, WEANING  
WEIGHT AND WEANING WEIGHT RATIO OF CALVES FROM 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE II, PHASE 3, - COWS BORN IN 1975-76

Breed of Dam of Heifer		No. Calves Born	Type of Parturition, %				Calf Crop, % <sup>c</sup>			Calf Mortality, % <sup>d</sup>			Calf Wt., lb. <sup>e</sup>	
Sire	Dam		No Diff.	Calf- Puller	C- Section	Abn. Pre- sentation	Born	Weaned	Early	Late	Birth	200- Day	200-Day Wt. Ratio <sup>f</sup>	
Angus Hereford	Hereford	11	51.1	26.8	14.2	7.9	96.4	92.7	1.9	1.1	74.5	443	98.9	
	Angus	11	46.6	47.5	6.0	10.4	95.5	67.2	32.6	0.0	73.2	453	101.1	
	Average	22	48.9	37.1	4.8	9.2	95.9	79.9	17.3	0.7	73.8	448	100.0	
Red Poll	Hereford	15	77.6	22.5	3.9	0.0	92.4	83.4	7.9	1.1	75.6	435	97.1	
	Angus	13	85.7	11.8	6.3	0.0	79.8	64.5	13.2	6.4	79.7	491	109.6	
	Average	28	81.7	17.2	5.1	0.0	86.1	74.0	10.5	3.7	77.7	463	103.3	
Brown Swiss	Hereford	17	80.4	15.4	3.0	1.2	90.0	72.5	19.6	0.0	73.9	478	106.7	
	Angus	13	0.0	54.6	14.6	34.7	88.5	66.8	20.1	7.5	81.8	485	108.3	
	Average	30	38.2	35.0	8.8	18.0	89.2	69.6	19.8	2.9	77.8	481	107.4	
Gelbvieh	Hereford	12	36.2	46.9	0.3	16.6	92.4	85.5	5.2	1.7	83.3	487	108.7	
	Angus	14	57.4	29.2	16.6	0.0	95.2	87.1	9.1	0.0	80.2	450	100.4	
	Average	26	46.8	38.1	8.4	6.7	93.8	86.3	7.1	0.8	81.8	469	104.7	
Maine Anjou	Hereford	15	66.1	29.8	4.9	0.0	82.5	67.5	1.9	11.1	74.3	453	101.1	
	Angus	13	41.9	52.7	4.0	1.5	96.0	75.7	12.8	8.1	76.6	441	98.4	
	Average	28	54.0	41.2	4.4	.4	89.3	71.6	7.4	9.6	75.4	447	99.8	
Chianina	Hereford	17	80.5	21.4	0.4	0.0	105.8	101.8	2.3	1.5	77.8	456	101.8	
	Angus	19	51.7	41.4	1.8	5.1	95.4	84.1	9.6	0.0	80.3	460	104.5	
	Average	36	66.1	31.4	1.1	1.4	100.6	92.9	5.9	0.8	79.1	458	102.2	
Average All Sire Breeds	Hereford	87	65.3	27.1	4.5	3.1	93.3	83.9	6.4	5.4	80.5	459	102.5	
	Angus	83	46.5	39.5	6.5	7.5	91.7	74.2	16.2	0.3	74.7	463	103.3	
	Average	170	55.9	33.3	5.5	5.3	92.5	79.1	11.3	2.9	77.6	461	102.9	

<sup>a</sup> Calves from these cows were sired by Shorthorn bulls.

<sup>b</sup> No assistance or minor hand assistance.

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, being open two successive years or by death.

<sup>d</sup> Early mortality is within 72 hr. of birth; late is from 72 hr. after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 5.9 for birth weight and 28 lb. for 200-day weight.

<sup>f</sup> Ratio computed relative to 448 lb. average for Hereford and Angus sired dams.



TABLE 6. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 2-YEAR-OLDS  
CYCLE II, PHASE 3 - COWS BORN IN 1975-76

Breed of Cow		No. Calving as 2-Year Olds	Avg. Calving Date	Percent Preg. <sup>a</sup>	Cow Weight, lb <div>2½ Years</div>	Condition Score <sup>b</sup> <div>2½ Years</div>
Sire	Dam					
Angus Hereford	Hereford	11	March 19	81.5	979	6.3
	Angus	11	March 15	85.0	959	6.8
	Average	22	March 12	83.3	969	6.6
Red Poll	Hereford	15	March 10	89.6	959	6.4
	Angus	13	March 16	86.0	994	6.2
	Average	28	March 13	87.8	976	6.3
Brown Swiss	Hereford	17	March 10	90.4	1007	6.5
	Angus	13	March 14	76.5	1024	6.0
	Average	30	March 12	83.5	1015	6.3
Gelbvieh	Hereford	12	March 17	94.7	1046	6.1
	Angus	14	March 21	87.4	1024	6.2
	Average	26	March 19	91.1	1035	6.1
Maine Anjou	Hereford	15	March 8	94.7	1053	6.0
	Angus	13	March 12	97.8	1046	6.6
	Average	28	March 10	96.2	1049	6.3
Chianina	Hereford	17	March 17	97.0	1044	6.0
	Angus	19	March 11	95.0	1050	5.9
	Average	36	March 14	96.0	1047	5.9
Average All Sire Breeds	Hereford	87	March 12	91.3	1015	6.2
	Angus	83	March 15	87.9	1016	6.3
	Average	170	March 14	89.6	1016	6.3

<sup>a</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = no. palpated as pregnant ÷ no. palpated, and only includes cows that calved prior to breeding.  
<sup>b</sup> Condition is scored on a scale of 1 to 9; 1 = thin, emaciated; 5 = average; 9 = very fat

TABLE 7. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT,  
WEANING WEIGHT AND WEANING WEIGHT RATIO OF CALVES FROM 2-YEAR-OLD COWS<sup>a</sup>  
CYCLE III, PHASE 2 - COWS BORN 1975-76

Sire	Breed of Cow	Dam	No. Calves Born	Type of Parturition, %			Calf Crop, % <sup>c</sup>			Calf Mortality, % <sup>d</sup>			Birth	Calf Wt., lb <sup>e</sup> 200-Day	200-Day Wt Ratio <sup>f</sup>
				No. Diff.	Calv- Puller	C- Section	Abn.	Pre- sentation	Born	Weaned	Early	Late			
Angus Hereford	Hereford		21	60.7	30.9	1.5		7.0	67.1	66.8	1.2	0.0	75.0	398	101.0
	Angus		60	34.8	50.7	11.4		3.1	83.8	70.8	14.2	1.4	74.1	389	98.7
	Average		81	47.8	40.8	6.4		5.0	75.5	68.8	7.7	0.4	74.6	394	100.0
Pinzgauer	Hereford		40	40.2	47.1	3.1		9.6	90.3	74.8	10.6	4.0	83.4	436	110.7
	Angus		58	52.7	39.6	3.9		3.8	80.0	74.0	4.8	0.8	78.9	425	107.9
	Average		98	46.5	43.3	3.5		6.7	85.1	74.4	7.7	2.4	81.1	431	109.4
Tarentaise	Hereford		31	53.9	39.3	0.0		6.9	94.0	84.8	9.9	0.0	79.8	456	115.7
	Angus		40	58.5	35.3	4.6		1.7	77.0	64.3	16.4	0.0	74.8	437	110.9
	Average		71	56.2	37.3	2.3		4.3	85.5	74.6	13.2	0.0	77.3	446	113.2
Brahman	Hereford		35	86.9	7.7	0.4		5.0	83.5	76.9	8.2	0.8	77.1	483	122.6
	Angus		55	87.1	11.0	2.7		0.0	89.5	80.7	6.7	2.4	75.4	490	124.4
	Average		90	87.0	9.4	1.5		2.1	86.5	78.8	7.4	1.6	76.2	486	123.4
Sahiwal	Hereford		30	89.3	10.4	0.4		0.0	93.6	90.2	3.9	0.0	68.5	453	115.0
	Angus		51	88.3	8.4	0.0		3.2	93.1	85.9	5.9	1.5	64.3	439	111.4
	Average		81	88.8	9.4	0.2		1.6	93.4	88.0	4.9	0.7	66.4	446	113.2
Average All Sire Breeds	Hereford		157	66.2	27.1	1.1		5.7	85.7	78.7	6.8	0.8	76.8	445	112.9
	Angus		264	64.3	29.0	4.5		2.2	84.7	75.1	9.6	1.2	73.5	436	110.7
	Average		421	65.2	28.0	2.8		3.9	85.2	76.9	8.2	1.0	75.1	441	111.9

<sup>a</sup> Calves from these cows were sired by Red Poll bulls.

<sup>b</sup> No assistance or minor hand assistance.

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, by death or being open two consecutive seasons.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 4.1 lbs for birth weight and 28 lbs for 200-day weight.

<sup>f</sup> Ratio computed relative to 394 lb average for Hereford and Angus sired dams.

TABLE 8. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 2-YEAR-OLD COWS  
CYCLE III, PHASE 2 - COWS BORN 1975-76

Sire	Breed of Cow		No. Calving as 2-Year-Olds	Avg. Calving Date <sup>a</sup>	Percent Preg. <sup>a,b</sup>	Cow Weight, 1b 2½-Year-Olds	Hip Height, in 2½-Year-Olds
		Dam					
Angus Hereford	Hereford Angus Average		21 60 81	March 11 March 15 March 13	98.0 87.8 92.9	976 965 971	47.9 47.2 47.5
Pinzgauer	Hereford Angus Average		40 58 98	March 16 March 14 March 15	90.6 90.0 90.3	980 964 972	49.4 48.5 49.0
Tarentaise	Hereford Angus Average		31 40 71	March 17 March 16 March 16	87.8 83.2 85.5	974 950 962	49.4 48.4 48.9
Brahman	Hereford Angus Average		35 55 90	March 20 March 16 March 18	95.6 93.3 94.4	1013 1012 1012	51.3 51.0 51.1
Sahiwal	Hereford Angus Average		30 51 81	March 17 March 18 March 17	96.9 100.0 98.6	915 875 895	49.8 48.6 49.2
Average All Sire Breeds	Hereford Angus Average		157 264 421	March 16 March 16 March 16	93.8 90.9 92.3	971 953 962	49.6 48.7 49.1

<sup>a</sup> Includes cows calving at 2 and 3 years of age.

<sup>b</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = no. palpated as pregnant ÷ no. palpated, and only includes cows that calved prior to breeding.

TABLE 9. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DIFFICULTY, CALF CROP PERCENTAGE, CALF MORTALITY, BIRTH WEIGHT  
WEANING WEIGHT AND WEANING WEIGHT RATIO OF CALVES FROM 3-YEAR-OLD COWS<sup>a</sup>  
CYCLE III, PHASE 2 - COWS BORN 1975

Sire	Breed of Cow Dam	No. Calves Born	Type of Parturition, %			Calv Crop, % <sup>c</sup>			Calv Mortality, % <sup>d</sup>			Calv Wt, lb <sup>e</sup>	
			No Diff.	b Puller	C- Section	Abn. Pre- sentation	Born	Weaned	Early	Late	Birth	200- Day	200-Day <sup>f</sup> Wt Ratio
Angus Hereford	Hereford	21	90.0	4.7	0.0	5.3	100.0	90.5	9.8	0.1	79.8	455	103.4
	Angus	48	83.2	12.6	0.0	4.2	94.0	86.0	8.3	0.0	78.3	426	96.8
	Average	69	86.6	8.7	0.0	4.8	97.0	88.2	9.1	0.0	79.0	440	100.0
Pinzgauer	Hereford	29	78.1	19.0	0.0	3.1	90.3	80.6	7.1	6.9	87.3	482	109.5
	Angus	43	85.1	10.1	2.7	2.1	87.8	79.6	8.7	0.0	84.7	470	106.8
	Average	72	81.6	14.6	1.2	2.6	89.0	80.1	7.9	3.4	86.0	476	108.2
Tarentaise	Hereford	13	91.6	8.1	0.2	0.1	76.5	76.5	0.1	0.0	83.6	503	114.3
	Angus	16	90.7	0.0	5.4	4.8	84.2	78.9	5.0	0.0	78.1	487	110.7
	Average	29	91.2	3.6	2.8	2.4	80.3	77.7	2.5	0.0	80.9	495	112.5
Brahman	Hereford	31	100.0	0.0	0.0	0.1	96.8	90.3	3.3	3.2	75.2	515	117.0
	Angus	35	100.0	0.0	0.0	0.0	89.7	84.6	5.7	0.0	73.3	511	116.1
	Average	66	100.0	0.0	0.0	0.0	93.3	87.5	4.5	1.6	74.3	513	116.6
Sahiwal	Hereford	13	92.5	7.3	0.0	0.1	100.0	100.0	0.1	0.0	73.3	490	111.4
	Angus	19	100.0	0.0	0.0	0.0	100.0	84.2	0.0	14.5	69.2	492	111.8
	Average	32	96.5	3.5	0.0	0.0	100.0	92.1	0.0	6.9	71.2	491	111.6
Average All Sire Breeds	Hereford	107	90.5	7.8	0.0	1.7	92.7	87.6	4.1	1.9	79.8	489	111.1
	Angus	161	91.9	4.3	1.6	2.2	91.1	82.7	5.5	2.9	76.7	477	108.4
	Average	268	91.2	6.1	0.8	2.0	91.9	85.1	4.8	2.4	78.3	483	109.8

<sup>a</sup> Calves from these cows were sired by 7/8 Simmental bulls (appendix table 6).

<sup>b</sup> No assistance or minor hand assistance.

<sup>c</sup> Of cows alive at calving; cows removed from experiment only for serious injury, by death or being open two consecutive seasons.

<sup>d</sup> Early mortality is within 72 hr of birth; late is from 72 hr after birth until weaning.

<sup>e</sup> Adjusted to a steer basis. Least-squares adjustment factors for heifers were 2.8 lbs for birth weight and 16 lb for 200-day weight.

<sup>f</sup> Ratio computed relative to 440 lb average for Hereford and Angus sired dams.

TABLE 10. ROMAN L. HRUSKA U.S. MEAT ANIMAL RESEARCH CENTER GERM PLASM EVALUATION PROGRAM  
CALVING DATE, REBREEDING PERFORMANCE AND SIZE OF COWS CALVING AS 3-YEAR-OLDS  
CYCLE III, PHASE 2 - COWS BORN 1975

Sire	Breed of Cow		No. Calving as 3-Year-Olds	Avg. Calving Date <sup>a</sup>	Percent Preg. <sup>a,b</sup>	Cow weight, lb 3 1/2-Year-Olds	Hip Height, in 3 1/2-Year-Olds
		Dam					
Angus Hereford	Hereford		21	April 4	95.2	1094	48.3
	Angus		48	April 8	97.9	1023	47.3
	Average		69	April 6	96.6	1059	47.8
Pinzgauer	Hereford		29	April 1	100.0	1105	50.2
	Angus		43	March 31	97.6	1070	49.5
	Average		72	April 1	98.8	1088	49.9
Tarentaise	Hereford		13	April 4	92.3	1087	49.6
	Angus		16	April 5	93.8	1069	49.3
	Average		29	April 5	93.0	1078	49.4
Brahman	Hereford		31	April 7	93.3	1093	51.8
	Angus		35	April 6	100.0	1109	51.5
	Average		66	April 6	96.7	1101	51.7
Sahiwal	Hereford		13	April 4	100.0	1030	51.1
	Angus		19	March 31	88.9	941	48.7
	Average		32	April 2	94.4	986	49.9
Average All Sire Breeds	Hereford		107	April 4	96.2	1082	50.2
	Angus		161	April 4	95.6	1043	49.3
	Average		268	April 4	95.9	1062	49.7

<sup>a</sup> Includes cows calving at 3 years of age.

<sup>b</sup> Breeding period was 63 days by natural service to 7/8 Simmental bulls. Percent pregnant = no. palpated as pregnant ÷ no. palpated, and only includes cows that calved prior to breeding.

# APPENDIX

TABLE 1. MATING PLANS TO PRODUCE CYCLE I, PHASE 2 CALVES

1969, 1970, 1971 Breeding Seasons

Dam Breeds <sup>a</sup>	Sire Breeds						
	Hereford	Angus	Jersey	South Devon	Limousin	Simmental	Charolais
Hereford	X	X	X	X	X	X	X
Angus	X	X	X	X	X	X	X

<sup>a</sup> The cows were 1, 2, 3 and 4-year-olds in 1969; 1, 2, 3, 4 and 5-year-olds in 1970; and 2, 3, 4, 5 and 6-year-olds in 1971.

# APPENDIX

TABLE 2. MATING PLANS TO PRODUCE CYCLE II, PHASE 2 CALVES

1972 and 1973 Breeding Seasons

Dam Breeds <sup>a</sup>	Sire Breeds						
	Hereford <sup>b</sup>	Angus <sup>b</sup>	Red Poll	Brown Swiss	Gelbvieh	Maine Anjou	Chianina
Hereford <sup>c</sup>	X	X	X	X	X	X	X
Angus <sup>c</sup>	X	X	X	X	X	X	X
Red Poll	X	X	X	X			
Brown Swiss	X	X	X	X			

<sup>a</sup> The cows were 3, 4, 5, 6 and 7-year-olds in 1972; and 3, 4, 5, 6, 7 and 8-year-olds in 1973.

<sup>b</sup> Sample of same Hereford and Angus sires used in Cycle I, 1969, 1970 and 1971 breeding seasons.

<sup>c</sup> Cows used for GPE Cycle I, 1969, 1970 and 1971 breeding seasons.

TABLE 3. MATING PLANS TO PRODUCE CYCLE I, PHASE 3 CALVES

	First Calf Crop <sup>b</sup>					Sire Breeds				Second Calf Crop <sup>c</sup>				Subsequent Calf Crops <sup>d</sup>
Breed Group <sup>a</sup>	Here- ford	Angus <sup>e</sup>	Brahman	Devon	Hol- stein	Here- ford	Angus <sup>e</sup>	Gelb- vieh	Maine Anjou	Chia- nina				Brown Swiss
H x H		X											X	
A x A	X					X							X	
A x H			X	X	X			X	X	X			X	
H x A			X	X	X			X	X	X			X	
J x H		X	X	X	X		X	X	X	X			X	
J x A	X		X	X	X	X		X	X	X			X	
SD x H		X	X	X	X		X	X	X	X			X	
SD x A	X		X	X	X	X		X	X	X			X	
L x H		X	X	X	X		X	X	X	X			X	
L x A	X		X	X	X	X		X	X	X			X	
S x H		X	X	X	X		X	X	X	X			X	
S x A	X		X	X	X	X		X	X	X			X	
C x H		X	X	X	X		X	X	X	X			X	
C x A	X		X	X	X	X		X	X	X			X	

<sup>a</sup> Females of each breed group distributed equally among cells marked "X" for each calf crop.

<sup>b</sup> Each group of heifers bred as yearlings to produce one calf crop as 2-year-olds by these breeds.

<sup>c</sup> Each group of cows bred as 2-year-olds to produce one calf crop as 3-year-olds by these breeds.

<sup>d</sup> Each group of cows bred to produce at least two calf crops by this breed.

<sup>e</sup> Sample of same sired used in Cycle I, 1969-70-71 breeding seasons.



## APPENDIX

TABLE 4. MATING PLANS TO PRODUCE CYCLE II, PHASE 3 CALVES

Female Breeding Groups <sup>a</sup>	First Calf Crop <sup>b</sup>				Subsequent Calf Crops <sup>c</sup>
	Hereford <sup>d</sup>	Angus <sup>d</sup>	Brangus	Santa Gertrudis	Simmental
Hereford		X	X	X	X
Angus	X		X	X	X
Red Poll	X	X			X
Brown Swiss	X	X			X
H x A & Recip.			X	X	X
H x R.P. & Recip.		X	X	X	X
H x B.S. & Recip.		X	X	X	X
A x R.P. & Recip.	X		X	X	X
A x B.S. & Recip.	X		X	X	X
Gelbvieh x Hereford			X	X	X
Gelbvieh x Angus	X		X	X	X
Maine Anjou x Hereford		X	X	X	X
Maine Anjou x Angus	X		X	X	X
Chianina x Hereford		X	X	X	X
Chianina x Angus	X		X	X	X

<sup>a</sup> Females of each breed group distributed equally among the cells marked "X" for each calf crop.

<sup>b</sup> Each group of heifers bred as yearlings to produce one calf crop as 2-year-olds by these breeds.

<sup>c</sup> Each group of cows mated to produce at least three calf crops by 3/4 or 7/8 Simmental bulls.

<sup>d</sup> Sample of same Hereford and Angus sires used in Cycle I, Phase , 1969, 1970 and 1971 breeding seasons.

# APPENDIX

TABLE 5. MATING PLANS TO PRODUCE CYCLE III, PHASE 2 CALVES<sup>a</sup>

1974 and 1975 Breeding Seasons

Female Breeds <sup>b</sup>	Male Breeds					
	Hereford <sup>c</sup>	Angus <sup>c</sup>	Brahman	Sahiwal	Pinzgauer	Tarentaise
Hereford		X	X	X	X	X
Angus	X		X	X	X	X

<sup>a</sup> Approximately 256 heifers (32 of each breed group, except Tarentaise) were transferred to Brooksville, Fla. The F<sub>1</sub> heifers were bred naturally to Red Poll bulls for their first calf-crop and to Simmental bulls for subsequent calf-crops.

<sup>b</sup> Cows used for GPE Cycle I, Phase 1.

<sup>c</sup> Sample of same Hereford and Angus sires used in Cycle I, Phase I 1969, 1970 and 1971 breeding seasons.



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